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Comparison of patients who underwent video-assisted thoracoscopic surgery or thoracotomy

Thoracoscopic surgery/thoracotomy

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Abstract

Aim: Thoracotomy is one of the surgical procedures used in thoracic surgery. The morbidities in this method are related to the size of the surgical incision. Video-assisted thoracoscopic surgeries (VATS) are operations performed to reduce surgical morbidity without sacrificing basic surgical principles. Smaller and fewer incisions are made in VATS compared to thoracotomy. In our study, we aimed to compare the advantages and disadvantages of patients who underwent video-assisted thoracoscopic surgery or thoracotomy.

Material and Methods: Patients (n;47) were divided into two groups as patients who underwent VATS (Group 1; 28) and open surgery (thoracotomy) (Group 2; 19). Age, gender, localization of the disease, diagnosis, surgeries, duration of surgery, pain scores, length of stay, complications, and mortality of the patients in each group were recorded. Values were recorded as numerical expressions ranging from zero (no pain) to 10 (very severe pain). The groups were compared statistically.

Results: When the groups were compared, there was no significant difference between the groups in terms of gender, localization, and mean age ($p>0.05$). However, it was seen that Group 1 had significantly lower scores compared to Group 2 in terms of duration of surgery, length of hospital stay, and pain. Moreover, it was observed that in Group 1 complication rates were significantly lower compared to Group 2.

Discussion: VATS is prominent as it is less invasive compared to thoracotomy and the postoperative period is more comfortable. It has much more advantages than the thoracotomy procedure. Therefore, we strongly suggest that VATS be preferred to thoracotomy when possible and be strictly applied.

Keywords

Advantages, Disadvantages, Thoracotomy, Video-assisted thoracoscopic surgeries

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Introduction

Thoracotomy is one of the surgical procedures used in thoracic surgery. The morbidities in this method are related to the size of the surgical incision. Thoracotomy is mostly used for diaphragm, esophagus, trachea, chest wall, heart, and lung surgeries. In this procedure, the chest cavity is entered through an incision made between the ribs. Additionally, different surgical incisions are made on the anterior, lateral, and posterior walls of the chest, depending on the type of operation. Each incision has its own morbidities [1].

Video-assisted thoracoscopic surgeries (VATS) are operations performed to reduce surgical morbidity without sacrificing basic surgical principles. Smaller and fewer incisions are made in VATS compared to thoracotomy. This method, which causes less damage to the bone structures, is a surgical procedure that reduces the morbidity-mortality of the patient, provides a shorter hospital stay, and enables an earlier return to physical activity [2].

In our study, we aimed to compare the advantages and disadvantages of patients who underwent video-assisted thoracoscopic surgery or thoracotomy.

Material and Methods

Patients

In the study, which was within the scope of a scientific research project and approved by the ethics committee, a total of 47 patients who underwent VATS or thoracotomy in the last year (January 2021-December 2021) were included.

Procedures

Patients were divided into two groups as patients who underwent VATS (Group 1) and open surgery (thoracotomy) (Group 2). Age, gender, localization of the disease, diagnosis, surgeries, duration of surgery, pain scores, length of stay, complications, and mortality of the patients in each group were recorded. Values were recorded as numerical expressions ranging from zero (no pain) to 10 (very severe pain). The groups were compared statistically.

Inclusion and exclusion criteria

Patients who did not undergo VATS or thoracotomy and who were started with thoracoscopic methods and then switched to thoracotomy were not included in the study.

Statistical analysis

IBM SPSS Statistics Base 22.0 program (IBM Corporation, Armonk, NY, USA) was used for data analysis. Continuous variables were expressed as mean ± standard deviation, while categorical variables as number-ratio. Homogeneity analysis of variances was performed using Levene's test ($p>0.05$). The Shapiro-Wilk test was used to evaluate the normal distribution ($p>0.05$). The results were evaluated with the Mann-Whitney U and Fisher's exact tests. $P<0.05$ was considered significant.

Ethical Approval

Ethics Committee approval for the study was obtained.

Results

The mean age of patients in Group 1 (n:28) was 38.89 ± 22.55 years; 17 (60.71%) patients were male and 11 (39.28%) were female. In 21 (75%) patients, the disease was right localized and in 7 (25%), it was left localized. The mean age in Group 2 (n: 19) was 50.36 ± 18.37 years; 15 (78.94%) patients were male and 4 (21.05%) were female. In thirteen patients (68.42%), the disease was located on the right, and in 6 (31.57%) it was on the left. When the groups were compared, there was no significant difference between the groups in terms of gender, localization, and mean age ($p>0.05$) (Figure 1, Table 1).

Nine (32.14%) patients in Group 1 had chest wall deformities, 4 had (14.28%) hyperhidrosis, 1 (3.57%) had interstitial lung disease, 1 (3.57%) had pleural thickening, 12 (42.85%) had pleural thickening + effusion, and 1 (3.57%) had primary spontaneous pneumothorax. In Group 2, 2 patients (10.52%) suffered from lung cancer, 3 (15.78%) had loculated pleural effusion, 5 (26.31%) had empyema, 1 (5.26%) had mesothelioma, 1 (5.26%) had diaphragmatic eventration, 4 (21.05%) had hydatid cyst,

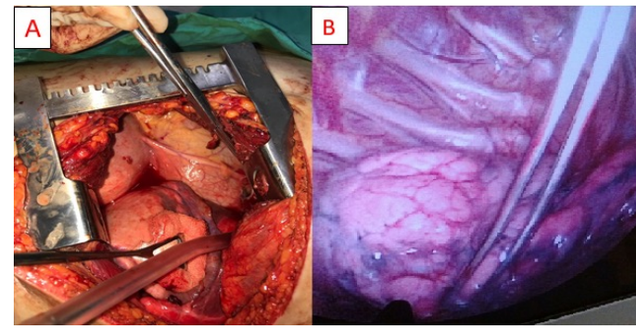

Figure 1. Images of thoracotomy and thoracostomy procedures

Table 1. Demographic distribution of patients who underwent thoracoscopic surgery (Group 1) or thoracotomy (Group 2).

	Group 1; 28	Group 2; 19	The z-score	p
Male	17	15	----------	0.2202
Female	11	4		
Right localization	21	13	----------	0.7431
Left localization	7	6		
Average age	38.89 ± 22.55	50.36 ± 18.37	-174.506	0.08012
Average operative time	34.82 ± 7.26	93.68 ± 4.98	-647.465	< .00001
Average length of stay	4.96 ± 3.54	10.94 ± 7.59	-354.431	0.0004
Average pain score	4.21 ± 0.73	7.52 ± 0.51	-575.544	< .00001
Complication	13	17	----------	0.0046

Table 2. Diagnosis and surgery of patients who underwent thoracoscopic surgery (Group 1) or thoracotomy (Group 2)

Group 1; 28 Diagnosis/Surgery	Group 2; 19 Diagnosis/Surgery
Chest deformation/Nuss operation	Lung carsinom/lobectomy
Hyperhidrosis/Sympathectomy	Locule pl. ef./Empyemectomy+decort
Interstitial lung diseases/Lung wedge resection	Empyema/Empyemectomy+decort
Pleural thickening/Pleural biopsy	Mesothelioma/Plevrectomy
Pleural thickening+efusion/Pleural biopsy+decort	Diaphragm eventration/Plication+reconst
PSP/bulla excision+pleurectomy	Hydatid cyst/Cystotomy+capitonage
	PSP/Bulla excision+pleurectomy
	Morgagni hernia/Hernia sac repair
	Mediastinal mass/Excision of the mass

Decort; decortication, PSP; Primary spontaneous pneumothorax, Pl; pleural, Ef; efusion, Reconst; recostruction

Table 3. Distribution of complications in patients who underwent thoracoscopic surgery (Group 1) or Thoracotomy (group 2)

Complication	Group 1	Group 2	p
Partial pneumothorax	6	2	
Continuing the drainage	2	-	
Pain	2	7	
Infection	1	2	0.0046
Prolonged air leakage + expansion defect	1	6	
Bleeding	-	2	

1 (5.26%) had pneumothorax, 1 (5.26%) had morgagni hernia, and 1 (5.26%) had mediastinal mass.

In Group 1, 6 (21.42%) patients underwent pleural biopsy + decortication, 4 (14.28%) underwent sympathectomy, 1 (3.57%) underwent wedge resection, 7 (25%) underwent pleural biopsy, 1 (3.57%) underwent bullectomy + pleurectomy, and 9 (32.14%) underwent nuss operation. In Group 2, 2 (10.52%) patients underwent lobectomy, 7 (36.84%) underwent empyemectomy + decortication, 2 (10.52%) underwent pleurectomy, 1 (5.26%) underwent plication + reconstruction, 4 (21.05%) underwent cystotomy + decoration, 1 (5.26%) underwent bullectomy + pleurectomy, 1 (5.26%) underwent hernia repair, and 1 (5.26%) underwent mediastinal mass excision (Table 2).

The mean duration of surgery in Group 1 was 34.82 ± 7.26, the mean hospital stay was 4.96 ± 3.54, and the mean pain score was 4.21 ± 0.73. In Group 2, the mean duration of surgery was 93.68 ± 14.98, the mean hospital stay was 10.94 ± 7.59, and the mean pain score was 7.52 ± 0.51. When the groups were compared, it was seen that Group 1 had significantly lower scores compared to Group 2 in terms of duration of surgery, length of hospital stay, and pain ($p<0.05$) (Table 1).

Complications developed in 13 (46.42%) patients in Group 1. Six (21.42%) patients had partial pneumothorax, 2 (7.14%) had prolonged drainage, 1 (3.57%) had expansion defect, 2 (7.14%) had pain, and 1 (3.57%) had infection. Complications developed in 17 (89.47%) patients in Group 2. Two (10.52%) patients had partial pneumothorax, 6 (31.57%) had prolonged air leak+expansion defect, 2 (10.52%) had bleeding, 7 (36.84%) had pain, and 2 (10.52%) had infection. When the groups were compared, it was observed that in Group 1 complication rates were significantly lower compared to Group 2 ($p<0.05$) (Tables 1, 3).

Discussion

VATS is a surgical procedure performed in operating room conditions, under general anesthesia, over the image projected on the monitor via an endocamera placed in the pleural cavity, with instruments inserted into the thorax through a 2-3 cm chest wall incision, mostly 1,2 sometimes 3 pieces. The collapse of the lung during the procedure allows the exploration of the thoracic cavity and allows the surgical instruments to move freely in the cavity. To be able to do this, double-lumen endotracheal tubes are used. Patients are placed on the operating table in the lateral decubitus position. Since in case of insufficiency of the method and the development of complications, posterolateral thoracotomy can be performed [2, 3]. In our study, all thoracoscopic or thoracotomy surgeries were under general anesthesia; all patients who underwent thoracoscopic surgery and some of the patients who underwent thoracotomy were intubated with a double-lumen tube.

Depending on the type of surgery to be performed in VATS, a 2 cm skin incision is made in the intercostal space, the muscles are passed with blunt dissection, and the parietal pleura is opened. With developing pneumothorax, the lung collapses. If there is no pleural adhesion, the endocamera is inserted into the thorax. Then, the locations of other ports for surgical instruments are determined. According to the process, two or more ports can be opened [4]. In thoracotomy, the chest cavity is entered through an incision made between the ribs after a skin, subcutaneous, and muscle tissue incision. It is an open surgical method mostly applied for diaphragm, esophagus, trachea, chest wall, heart, and lung surgeries [5]. In our study, 9 patients in Group 1 had chest wall deformities, 4 had hyperhidrosis, 1 had interstitial lung disease, 1 had pleural thickening, 12 had pleural thickening + effusion, 1 had primary spontaneous pneumothorax. Six underwent pleural biopsy + decortication (2 ports), 4 underwent sympathectomy (1 port), 1 underwent wedge resection (2 ports), 7 underwent pleural biopsy (1 port), 1 underwent bullectomy+pleurectomy (2 ports), and 9 underwent nuss operation (1 port).

In thoracotomy, different incisions are required for the anterior, lateral, and posterior chest wall, depending on the type of surgery. Anterior mediastinotomy (Chamberlain procedure), anterior thoracotomy, median sternotomy bilateral thoracosternotomy (clamshell incision), hemiclamshell/ trapdoor incision, anterior transcervical thoracotomy (dartavell incision), subxiphoid incision, axillary thoracotomy, lateral (muscle-sparing) thoracothoracotomy, thoracoabdominal incision (thoracophrenotomy), posterolateral (pl) thoracotomy, and high posterolateral thoracotomy (shaw-paulson) are the types of thoracotomy performed according to the type of operation [6-13]. In our study, 2 patients underwent lobectomy (pl thoracotomy), 7 patients underwent empyemaectomy + decortication (pl thoracotomy), 2 patients underwent patients pleurectomy (pl thoracotomy), 1 (5.26%) patient underwent plication + reconstruction (pl thoracotomy), 4 patients (21.05%) underwent cystotomy + decortication (pl thoracotomy), 1 (5.26%) patient underwent bullectomy + pleurectomy (axillary thoracotomy), 1 (5.26%) patient underwent hernia repair (pl thoracotomy), and 1 (5.26%) patient underwent mediastinal mass excision (pl thoracotomy)

Posterolateral (pl) thoracotomy is the most commonly used incision. It is a curved 'S-shaped incision extending from the anterior axillary line posteriorly, approximately 2-3 cm below the lower end of the scapula, from the posterior edge of the scapula and the midpoint of the vertebral groove, parallel to the contour of the scapula. The skin, subcutaneous tissue, latissimus dorsi, and serratus anterior muscle (or just the fascia of this muscle) are cut. Depending on the reason for the operation, the rhomboid and trapezius muscles may also be included in the procedure. Then, the intercostal space to be used is determined according to the operation. The pleura is opened and the thorax is entered by cutting through the intercostal muscles over the rib, which is located below the gap. The thoracic field of

view is increased by placing an intercostal retractor. Axillary thoracotomy is used in TOS surgery, cervical and/or first rib resection, thoracic sympathectomy, or surgery for apical bullous diseases. In the lateral decubitus position, a skin incision about 5-6 cm long is made between the pectoral muscle anteriorly and the latissimus dorsi posteriorly, on the armpit hairline curve, by hanging the ipsilateral arm at 90°. Subcutaneous and axillary fatty tissue is passed and the muscles are retracted anteriorly and posteriorly. The thorax is entered by dissection towards the intercostal space. Since the incision is small and deep, the field of view is limited. Structures such as the intercostal brachial nerve and the long thoracic nerve should be preserved [10-13]. In our study, 8 of the patients who underwent VATS (Group 1) were treated with 2 ports and 20 with 1 port. In Group 2, 8 patients underwent posterolateral thoracotomy and 1 axillary thoracotomy. The mean duration of surgery in Group 1 patients was 34.82 ± 7.26, while the mean duration of surgery in Group 2 was 93.68 ± 14.98. When the groups were compared, it was found that the approach used in Group 1 was more significant and appropriate than in Group 2 in terms of duration of surgery, that is, exposure to anesthesia.

The most important advantages of using VATS are that it is performed with 2, 3 or 4 incisions of 2 cm, does not require a blood transfusion, is less invasive compared to thoracotomy, has a more comfortable postoperative period, has more visual comfort provided by a larger-than-normal magnification, shortens the duration of surgery, does not require intensive care in the postoperative period, saving on cost and personnel, shortens hospital stay, and enables to return to a productive life especially in the young age group in the early postoperative period. On the other hand, the disadvantages are hemodynamic disorders due to single lung ventilation, tumor implantation in the thoracic wall (prevented by endopochetes), inability to localize intrapulmonary nodules, difficulty in palpation with fingers from ports, and the financial burden of disposable instruments [14, 15]. Disadvantages of thoracotomy include wound infections, respiratory failure due to cuts, arrhythmia, postoperative bleeding, prolonged air leaks, uncontrollable bleeding, intercostal neuralgia, severe pain, and prolongation of hospitalization [16-19]. In our study, the mean duration of hospitalization in Group 1 patients was 4.96 ± 3.54, and the mean pain score was 4.21 ± 0.73, while the mean hospitalization time of Group 2 was 10.94 ± 7.59 and the mean pain score was 7.52 ± 0.51. When the groups were compared, it was observed that Group 1 had significantly lower scores compared to Group 2 in terms of the length of stay and pain score.

Complications of VATS include injury to the lung with the thoracic cavity, lunchothorax (intrathoracic stomach insertion in patients who underwent VATS with the prediagnosis of empyema encystation due to air-fluid levels in the left hemithorax), with coagulated hemothorax-traumatic hemothorax misdiagnosis, evaluation of intrathoracic liver as coagulum and gallbladder as gangrenous lung during VATS, Aorta-pleuro-cutaneous Fistula, and false Hemithorax [14, 15]. In thoracotomy, wound infections, prolonged air leakage, expansion defect, severe and prolonged pain are the main complications [16-19]. In our study, complications developed in 13 patients in Group 1. Six of those had partial pneumothorax, 2 had prolonged drainage, 1 had expansion defect, 2 had pain, and 1 had an infection. On the other hand, complications developed in 17 patients in Group 2. Two of those patients had partial pneumothorax, 6 had prolonged air leak + expansion defect, 2 had bleeding, 7 had pain, and 2 had an infection. When the groups were compared, Group 1 had significantly lower scores compared to Group 2 in terms of complication rate.

Conclusion

VATS is prominent as it is less invasive compared to thoractomy and the postoperative period is more comfortable. It has much more advantages than the thoracotomy procedure. Therefore, we strongly suggest that VATS be preferred to thoracotomy when possible and be strictly applied.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

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